The assessment of corruption impact on the inflow of foreign direct investment

Cite as: AIP Conference Proceedings **1836**, 020011 (2017); https://doi.org/10.1063/1.4981951
Published Online: 05 June 2017

Ayshan Gasanova, Alexander N. Medvedev, and Evgeny I. Komotskiy

The Assessment of Corruption Impact on the Inflow of Foreign Direct Investment

Ayshan Gasanova[1, a)], Alexander N. Medvedev[1, 2, b)], Evgeny I. Komotskiy[1, c)]

[1]*Graduate School of Economics and Management, Ural Federal University, Mira, 19, Ekaterinburg, RUSSIA 620002*
[2]*Institute of Industrial Ecology UB RAS, Sophy Kovalevskoy, 20, Ekaterinburg, RUSSIA 620990*

[a)]aishan.gas_1@mail.ru
[b)]Corresponding author: alnikmed52@gmail.com
[c)]komockye@mail.ru

Abstract. The aim of this paper is to investigate the impact of corruption on the inflow of foreign direct investment (FDI). The data, taken from official sources, Transparency International and the Heritage Foundation, have been treated in a special program "Deductor Studio Academic" by the method of Machine Learning (cluster analysis using Kohonen Self-Organizing Maps). There was composed a Kohonen map, in which the countries were divided into 4 clusters: countries with low levels of corruption and high level of FDI inflow, countries with low level of corruption and FDI above average, countries with average level of corruption and the average level of FDI, and countries with high level of corruption and low level of FDI. The research has shown that corruption influences the investment attractiveness of the host country. This means that in countries where the level of corruption is low and economic environment is attractive, the level of foreign direct investment is high, and in those countries where the level of corruption is high and and economic attractiveness is low – the level of investment is low. However, the study identified countries which have high level of corruption and high FDI inflow - China, India, Brazil and Russia (BRIC countries). These countries are the exception from the rule due to the wide domestic market, cheap labour, the wealth of natural resources - all these factors increase the investment attractiveness of these countries. It was found that corruption in BRIC countries has similarity being a controlled and predictable phenomenon. This allows calculating the cost of corruption for accounting it in business projects.
Keywords: Foreign direct investment, corruption, Corruption Perception Index, Machine Learning, Kohonen Self-Organizing Maps, cluster analysis, attractive economic environment, BRIC.
PACS: 89.65.Gh.

INTRODUCTION

The modern world economy is characterized by the movement between countries of production factors such as capital, labour, scientific and technical achievements. Companies that wish to successfully do business in a particular market abroad increasingly begin to focus not only on the export of manufactured goods, but also on the organization of its own production in a foreign country or purchasing the shares of local companies - this is a foreign direct investment (FDI). Regardless the level of economic development, each country is seeking to attract foreign capitals to obtain a positive effect for the economy. The reasons for the export and import of foreign direct investment are very diverse, but the most important ones are the desire to place the capital in the country and industry, where it will bring the maximum profit with minimal level of taxation.

Many researchers say that the investment attractiveness of the country depends on the level of corruption both in private and public sectors. Corruption includes bribery and any other behaviours of persons, having responsibility in the public or private sector, who violate their duties in order to obtain any improper advantage for themselves. The most authors consider the corruption as an illegal tax, a barrier for entering of new participants, as well as

Applied Mathematics and Computer Science
AIP Conf. Proc. 1836, 020011-1–020011-4; doi: 10.1063/1.4981951
Published by AIP Publishing. 978-0-7354-1506-5/$30.00

undermining of the legitimacy of the state and its ability to provide services of its institutions that support the proper functioning of economy spheres.

The World Bank studies show that corruption significantly reduces the volume of domestic and foreign investment. Looking at corruption as a kind of "tax" on business, they believe that every increase of this "tax" by 1% reduces the inflow of direct investment into the country by 5%.

Joseph S. Brada [1] conducted a study using data of FDI in 49 donor countries and 167 host countries in 2005-2009 years. The results showed that the corruption of the host countries has a negative impact on the volume of FDI inflows.

Daniel F. Runde [2] used data of 48 countries from 1998 to 2014 in order to determine the relationship between FDI and corruption. The results showed that corruption is statistically significant variable and has a negative impact on the investments inflow. He argues that the 1% decrease of corruption level can lead to the approximately 10% increase of FDI inflow into the country.

Cuervo-Cazurra [3] analyzed the inflow of foreign investment in 106 host countries. His research also has shown that corruption has a negative impact on the investment inflow. In this work there is also highlighted that investors from OECD member countries with a high level of corruption are not afraid to invest in countries with high levels of corruption. This is due to the fact that these investors already have the skills to work with corrupt officials, so the mechanisms of doing business in such environment are well known for them.

Dahlström and Johnson [4] conclude that corruption has a negative impact on the inflow of foreign direct investment in developing countries. Also, many economists as Alemu, Woo, Aparna [4 - 7] found that corruption discourages investment. In [7] the conclusion is made that the reduction of the corruption level at 1% can lead to an increase of FDI inflows in emerging economies at 9%.

All these researchers have concluded that corruption undermines economic freedom, by introducing the insecurity and uncertainty in economic relations which are the reasons of FDI inflows decrease. However, these scientists did not pay special attention to the countries that were exceptions and did not analyze the reasons why these countries came out of the generally accepted rules. The aim of this paper is an assessment the impact of corruption on FDI inflows, as well as determining the countries which are exceptions from the common rule.

METHODOLOGY

The calculation of corruption level in countries is carried by Transparency International, which calculates the corruption perceptions index (CPI) in 175 countries around the world. This index is a combination of researches and assessments of corruption, collected by a variety of reliable institutions, specializing in the management and analysis of business climate. The number of points, received by a country, indicates the perceived level of corruption in the public sector on a scale from 0 to 100, where 0 means that the level of corruption is considered to be very high, and 100 - very low.

Based on the data of Heritage Foundation Research Centre and Transparency International in the year 2015, the impact of corruption on the inflow of foreign direct investment was analyzed . The data were processed in the computer program Deductor Studio Academic for creating the Self-Organizing Kohonen Map (SOM) to investigate the impact of corruption on the FDI inflow.

Selection of SOM as clustering algorithm was due to its features:

- No need for a priori knowledge of the number of clusters;
- Ease of interpretation and visualization.

In 1975 Teuvo Kohonen [8] introduced new type of neural network that uses competitive unsupervised learning.

The learning process can be described by the following equation:

$$W_{\mathrm{i}} \leftarrow W_{\mathrm{i}} + \eta(x - W_{\mathrm{i}}) \quad (1),$$

where: $i \in [0..\text{numer of neurons}]$, W_i represents all synaptic weights of the winning neuron, η is learning rate and x stands for current input vector. This simple algorithm can be extended. The most common extension is giving more chance of winning to neurons that are rarely activated.

However, WTM (Winner Takes Most) strategy has better convergence than WTA (Winner Takes All). The difference between those two algorithms is that many neurons in WTM strategy adapt their synaptic weights in one learning iteration. In this case not only the winner, but also its neighborhood adapts. The further the neighboring neuron is from the winner, the smaller the modification which is applied to its weights. This adaptation process can be described for each neuron i that belongs to winner's neighborhood:

$$W_{\mathrm{i}} \leftarrow W_{\mathrm{i}} + \eta N(\mathrm{i}, x)(x - W_{\mathrm{i}}) \quad (2),$$

where: *Wi* stands for synaptic weights of neuron *i*, and *x* is current input vector. η stands for learning rate, and *N(i, x)* is a function that defines neighborhood.

Classical Self-Organizing Map can be created when function *N(i, x)* is defined as:

$$N(i,x)=\begin{cases}1 & for \quad d(i,w)\leqslant\lambda\\ 0 & for \quad others\end{cases} \tag{3},$$

where: *d(i, w)* is Euclidean distance between winning and *i*-th neuron; λ is a neighborhood radius.

To train Kohonen SOM, Euclidean distance between input vector and all neural weights has to be calculated. Neuron that has the shortest distance to input vector (the winner) is chosen and its weights are slightly modified to the direction represented by input vector.

Then neighboring neurons are taken and their weights are modified in the same direction.

η and λ are multiplied with $\Delta\eta$ and $\Delta\lambda$ respectively during each learning iteration.

RESULTS

For a comparative analysis of the clusters, their average values were calculated, which are shown in the Table 1.

TABLE 1. Average values of clusters

Clusters	Average values of freedom from corruption	Average values of FDI in clusters (million dollars)
1	61	108 050
2	72	69 704
3	57	23 353
4	40	2 019

In Figure 1 Self-Organizing Kohonen Map is built which shows the location and relationship of the clusters. The program has selected the similar countries on FDI inflows and freedom from corruption and divided them on 4 groups.

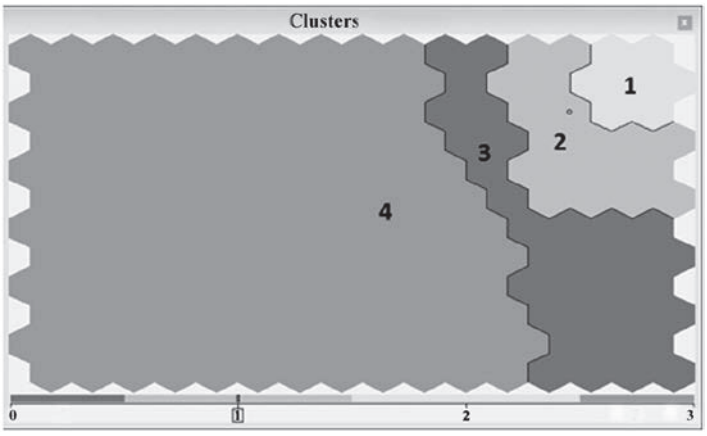

FIGURE 1. Cluster analysis results

So, all analyzed countries have been divided into 4 clusters, which can be characterized as follows:

Cluster 1 - the average value of the parameters in this group are 108 050 million dollars on FDI and 61 points on freedom from corruption. This group includes China, Hong Kong and the United States. But the level of freedom from corruption in China is fairly low - 36 points, which is below the average level for the group, however the FDI inflow is highest in the world - 128,500 million.

Cluster 2 - the average value of the parameters in this group are 69 704 million dollars on FDI and 72 points on freedom from corruption. This group includes such countries as United Kingdom, Singapore, Brazil, Canada and Australia. Countries in this group are characterized by low level of corruption, however the level of FDI is not the

highest, but above average level. Brazil, which has FDI level of 62 495 million, is in this group, despite low level of freedom from corruption (below average – 43 points).

Cluster 3 – the average value of the parameters in this group are 23 353 million dollars on FDI and 57 points on freedom from corruption. This group includes such countries as India, Chile, Spain, Mexico, Indonesia, Colombia, France, Poland, Turkey, Netherlands, Switzerland, Finland, Thailand. It is worth mentioning that the highest level of FDI inflow is seen in India (34,417 million), despite the fact that the level of protection from corruption in the country is one of the lowest in the group – 38 points. This group also includes highly developed countries (the Netherlands, Switzerland, Finland), which have very high level of freedom from corruption (above 80), but the level of FDI inflow is in the interval from 18 000 to 30 000. It can be assumed, that this is due to the expensive labour force and high tax burden that makes the countries unattractive for investors. This group also comprises Russia, whose level of freedom from corruption is below average level (only 27 points), but the FDI level is one of the highest in the group - 20,958 million dollars.

Cluster 4 – the average value of the parameters in this group are 2 019 million dollars on FDI and 40 points on freedom from corruption. The group includes 164 countries, mainly with low FDI inflows. Most of these countries can be characterized as developing countries with a low level of protection from corruption, small number of highly skilled professionals, the slow pace of economic development, the small size of the market - all these factors reduce the attractiveness of the economies for investment. However, this group also comprises highly developed countries such as Sweden, Norway, Germany, Denmark, New Zealand, which have a high security of economic system and freedom from corruption. Nevertheless, they are not attractive for investors due to expensive labour, high taxes and social burden, therefore the level of FDI inflows is low.

CONCLUSION

Summing up, it can be concluded that generally corruption affects the investment attractiveness of the country, but it is not the major factor affecting the FDI inflow. First of all, investments go into the countries with an attractive, transparent and open economy, with low levels of corruption. The reason is that then for investors it is easier to make the decision about investment, to calculate the profitability of the project. This is confirmed by such countries as the USA, UK, Canada, Australia and others. However, the Kohonen map shows that the leading positions are occupied by the countries with high level of corruption, as well as foreign direct investment, such as China, Brazil, India, which enter in the top ten highly invested countries, and also Russia, which came down to 16th position due to economic sanctions. Wide markets, low labour costs, a wide banking network, wealth of natural resources, access to warm seas - all these factors increase the investment attractiveness of BRIC countries and outweigh the corruption costs. Also, BRIC countries have the most similarities in the type and stage of economy and have similar government systems, hence corruption in these countries has common roots – it is controlled and predictable. So, the investors, working in these countries, have an opportunity to account the corruption costs in business projects.

REFERENCES

1. J. C. Brada, "Corruption and Multinational Investment: Micro-foundations and Empirical evidence", World Economic Journal (2014).
2. D. F. Runde, *The cost of corruption* (2014), https://csis-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/publication/140204_Hameed_CostsOfCorruption_Web.pdf.
3. Cuervo-Cazurra Alvaro, "Who Cares about Corruption?", Journal of International Business Studies, Vol. 37, No. 6, 807-822 (2006).
4. Dahlström, T. and Johnson, A., *Bureaucratic Corruption, MNEs and FDI* (Jönköping International Business School (JIBS), paper No. 82, 2007).
5. Aye Mengistu Alemu, "Effects of Corruption on FDI Inflow in Asian Economies", Seoul Journal of Economics, SolBridge International School of Business, Vol. 25, No. 4, 387-412 (2012).
6. J. Y. Woo, "The Impact of Corruption on a Country's FDI attractiveness; A Panel Data Analysis, 1984-2004", J. Int. Area Stud. 17(2), 71-91 (2010).
7. Aparna Mathur, "Foreign Direct Investment, Corruption, and Democracy", Applied Economics, Vol. 45, No. 8, (2011).
8. Kohonen, T., *Self-Organizing Maps, 3rd ed.* (New York: Springer-Verlag, 2001).